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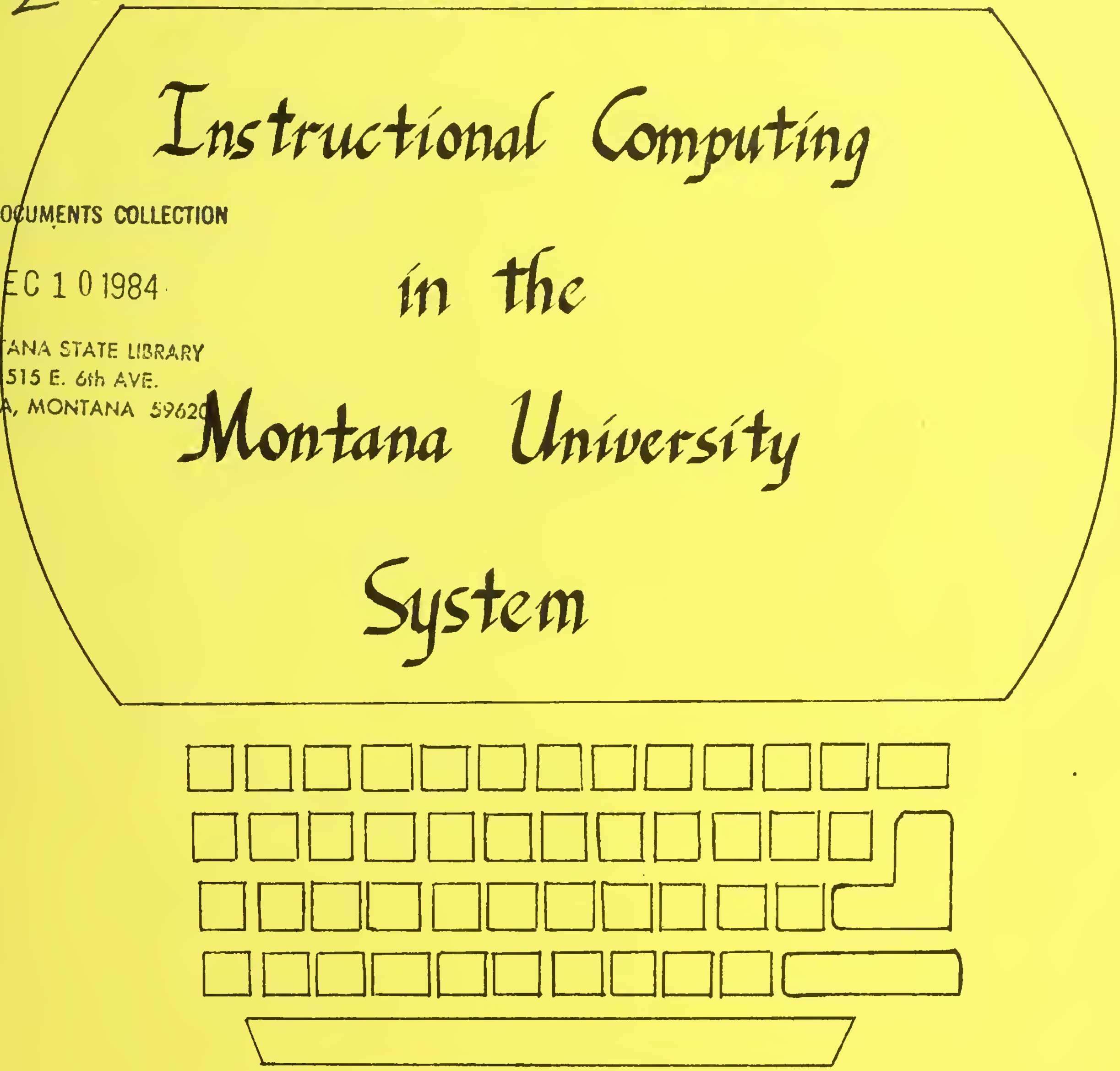
Instructional Computing in the Montana University System



April 1-2, 1982

Billings, Montana

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Instructional Computing
in the
Montana University System

Proceedings of a Conference
sponsored by the
System Faculty Vitality Project
and the
Northwest Area Foundation

April 1982

Eastern Montana College Campus

Billings, Montana

Program Chairman:
Dr. Stephen R. Hample
Director
Office of Institutional Research
Montana State University

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PREFACE

Computers, and especially micro-computers, are rapidly altering our society. Educational institutions, from elementary schools to universities, are responding to this growth in technology in different ways and at different rates. According to a recent Office of Public Instruction survey, some 600 micro- or mini-computers reside in Montana elementary and secondary schools. That number might easily double during the next year. Interestingly, it is often the smaller rural schools that have taken the lead in this area, and students in rural states such as Montana and Alaska probably will gain a higher level of computer competence than students in more populated states. One reason for this is that many small towns cannot afford to support a competitive football team, but with a $4,000 micro-computer, their students can compete on an equal footing in computer science with students at much larger schools.

Are graduating education majors sufficiently prepared for these new challenges? Will university professors be surprised by a sudden presence of computer literacy among their students? Most importantly, can new computer technology enhance college and university instruction in non-traditional ways and in non-traditional fields? To address these questions, interested System faculty were invited to share experiences and ideas at a one-day conference. Abstracts of the main conference presentations appear on the following pages and indicate a variety of applications among campuses and among fields of study.

What does the future hold? Computer technology will not only continue to change, but will do so even faster than during recent years. The University System will thus face a continuing, fundamental challenge. Within this challenge, however, is the opportunity for new learning, new instructional and research applications of technology, and the development of new fields of study; in short, a need and an opportunity for maintaining faculty vitality. Although these papers report only limited initial efforts, they demonstrate that Montanans are aware of the new technology and that Montana University System faculty members are capable of accepting this challenge. These efforts are currently limited only by computer funds and by the need to involve greater numbers of faculty members. This is an area in which greater resources might well be invested, both to improve service to students and to keep faculty interest and knowledge at a high level.

--- Steve Hample
Conference Program Chairman

A Water Resource Management Simulator

by Dr. John Amend, Montana State University

The development of a water resources management simulator at Montana State University is helping increase awareness of water management problems that currently plague Montana and the United States.

The program, established in 1977 at MSU, was designed to improve public awareness and understanding of the major factors involved in management of water resources. A series of workshops for community and school groups provide general level hydrologic information and give workshop participants an opportunity to develop and evaluate water management strategies through the use of a Water Resources Management Simulator.

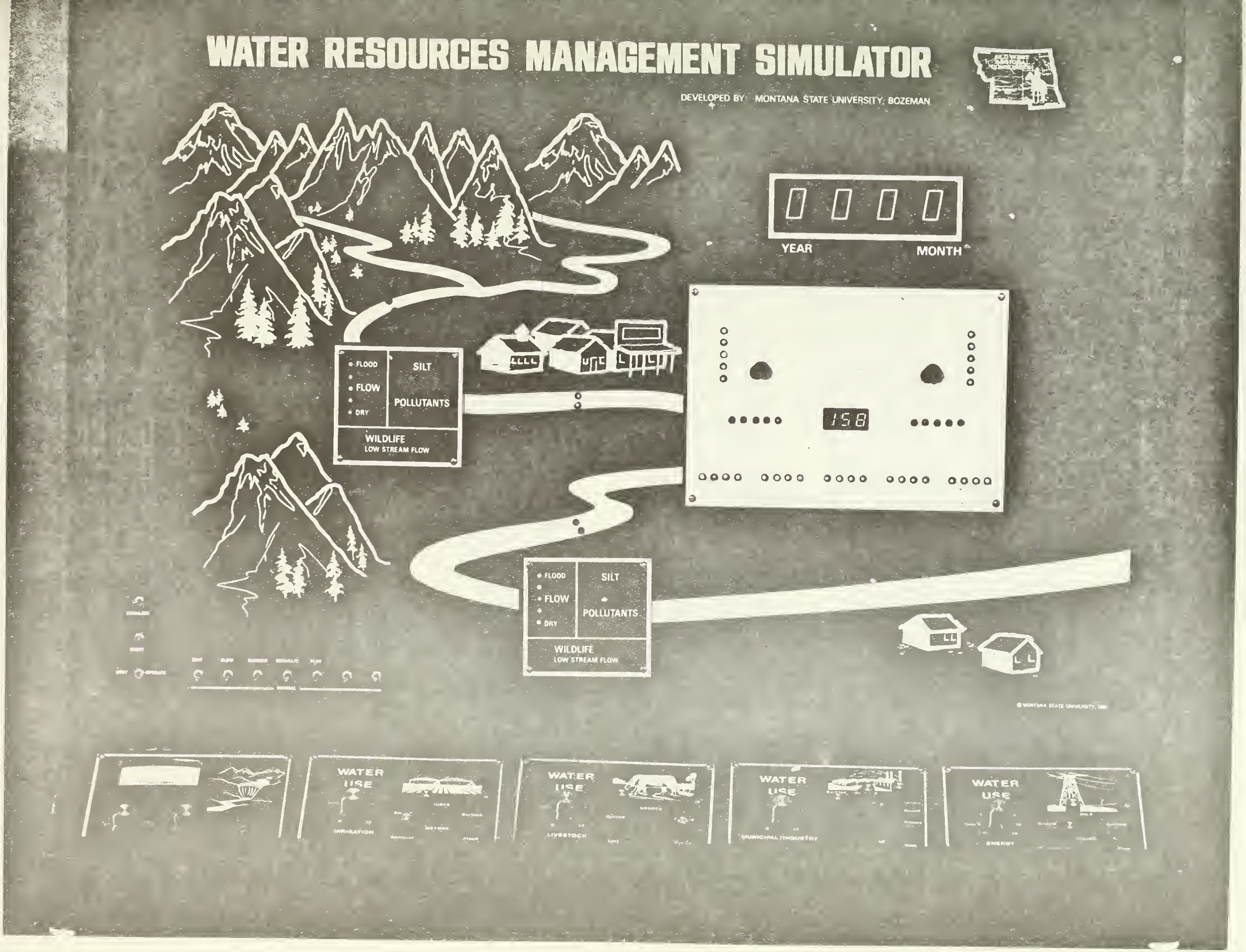
The simulator, which was developed at MSU, is a digital computer which models a region's water supply and demand. It places people using it in management situations similar to those faced by legislators and water management professionals, giving them a greater understanding and awareness of the factors which affect water policy decisions. Water management decisions regarding the storage of surface and ground water, rate of water use, sources of water, technology of water use, and disposition of used water are all made by members of the audience, using small control consoles. Individuals operating the controls govern the use and storage of water during a 10-year period. Supply, demand, reserve, and strains on the region's water resources are plotted on a color graphics display as the simulator operates. Level of snowpack, flooding, ground and surface reservoir depletion, level of pollutants, and a number of other variables that affect water management decisions are included in the computer model. The simulator may be programmed for any region's ground and surface water conditions by simply changing data statements in its memory.

The group using the simulator may interact with the computer at any time, changing variables to meet most effectively the problems posed by the simulator. After observing the results of a simulation, participants discuss the strong and weak points of their water management policy, modify their strategy, and try again.

One of the principal values of the simulator is its ability to place people in a decision-making situation involving real variables and alternatives and to project the probable consequences of their actions.

The program was originally funded by the Old West Regional Commission. Other support has come from the Office of Water Research and Technology, the Bureau of Reclamation, the Western Area Power Administration, the Montana Water Resources Research Center, and MSU's Vice President for Research.

Seventeen simulators are currently being used in 10 states and one Canadian province, with several others in development to treat specific



Simulator Developed by Dr. John Amend, MSU

regional problems. Through the efforts of the Cooperative Extension Service, the Water Center, and the Bureau of Reclamation, the program has gained national stature, with workshops being presented throughout the country. A national steering committee involving these agencies and several other universities and state water agencies has been established to direct the program's development.

Growth in the nation's population is placing an added strain on the water supply. Effective management of this resource is hampered by a lack of public understanding of the variables and limitations of the system. Decisions are being made today that will affect the lives of future generations, and responsible management of water resources requires the support of an informed public.

The development of the water simulator has resulted in the application of this technology to other problem areas. The Western Area Power Administration contracted with MSU to develop a power grid simulator, an interactive digital computer which models a segment of a power generation, transmission and load system. The simulator was designed to help professionals and lay people develop an understanding of the basic principles and technical complexity of the electrical power generation, transmission, and distribution system.

Several modes of operation permit the simulator to serve in training programs for workers in the electrical industry, as well as a tool for building public awareness of the principles and an understanding of the implementation of power management and economic policy by public and investor-owned power agencies. This simulator is principally used in WAPA's Hydropower Training Center in Denver.

Computer Based Quantitative Methods in the Biosciences

by Dr. Robert P. Banaugh, University of Montana

Bioscience students frequently experience far greater difficulty acquiring a familiarity and capability with mathematical methods than do engineering and physical science students. This fact, coupled with the growing recognition of the utility of quantitative techniques in the biosciences, has created a great need for teaching such techniques to bioscience students. The emergence of the digital computer, together with the development of easy-to-learn higher level programming languages, such as BASIC, has prompted me to develop a course in quantitative methods in which the language of mathematics can be bypassed. Expressions of quantitative hypotheses describing phenomena in the biosciences are formulated directly in BASIC.

BASIC was chosen for the course because it is available on small as well as large computers, and the ease with which students learn the language permits the teacher to emphasize underlying bioscience concepts. This in in contrast to a traditional mathematics approach wherein most of the course time must be spent developing the necessary mathematical machinery with which to s solve a problem or a class of problems. In addition, because numerical results are desired in most actual problems, frequently a computer must be used to obtain the numerical results from the mathematical form of the answers. Thus, even if the language of mathematics is used, the idea of proceeding directly to the computer from the pertinent bioscience immediately suggests itself.

The purpose of the course described here is to train the students to formulate problems directly in the programming language and then to use the programs so developed to analyze the implications of the hypotheses. I chose to emphasize simplicity in programming rather than the acquisition of programming techniques, feeling that these could come in a later course if students were "turned on" to the power and utility of quantitative methods.

The students in the course are primarily sophomores and juniors who have had an introductory bioscience course and, preferably, a course in BASIC programming. Most of them have had two or three years of secondary school mathematics but no calculus or advanced mathematics. Some of the topics discussed are population dynamics, life tables, population genetics, compartmental analysis, and the determination of model parameters.

The primary pedagogical objective of the course is to train students to formulate their own hypotheses and to then use these hypotheses as the basis for developing their own programs. In this way, the students learn to appreciate the role of hypotheses formulation in the scientific method. They also learn that a computer program, no matter how complex, is merely an expression of a set of hypotheses. This impression is to be contrasted with

the impressions obtained by students who have used "canned" programs or simulations and who as a result, come to believe the "canned" program or simulation represents reality. Since the emphasis is upon hypotheses formulation and the analysis of program results, the students spend a great deal of their time discussing their assumptions and their results. In contrast, in the more traditional mathematics based bioscience courses, most of the students effort is devoted to trying to understand the mathematical procedure or trick necessary to effect a solution to the governing equation. The ability of the course to concentrate the students' time and effort on learning more bioscience as opposed to learning a set of mathematical tricks is a valuable attribute of the course.

The students are also encouraged to alter their hypotheses or make up new sets of hypotheses, to then develop the corresponding program and to compare the program results to their intuition or data. In this way, the student's intuition and insight is increased and improved. A fundamental tenet of the course is "The purpose of computing is insight not numbers".

Instructional Computing in the Montana University System

by Dr. Joseph H. Bourque, Montana State University

Current Applications in English at Montana State University

Hardware: The Department has an account and a small budget for the large Honeywell computer managed by the Computing Center. Its capabilities are too extensive to describe here. Also, the Department now owns an Altos ACS8000-10 microcomputer. It is a multi-user system with both hard disk and floppy disk storage, and four stations.

Software: Wordstar, Datastar, Supersort, BASIC, Pascal, APL, Mailmerge, Dialogue, Compupoem, and PYLON.

Present Uses: a) Word Processing. Approximately half of the English faculty now regularly use the word processsor to produce articles and books. All users have reported increased efficiency. The secretarial staff is now using the word processor for a variety of applications in the English Office.

b) Computer-Assisted Instruction (CAI). *Dialogue is a set of drill and practice programs implemented on the Altos micro-computer. It focuses on sentence structure and was originally designed at the University of Texas. During Spring quarter, we will be using those programs as back-up remedial instruction for some of our Freshman Writing sections. *PYLON is an author language purchased from Stanford University, implemented on the Honeywell computer. It is now being used only for experimental design of thinking skills programs. *BASIC is currently being used on the Altos micro to create traditional drill and practice programs for remedial work in grammar and punctuation. Available commercial products have not been satisfactory. *Pascal is being used on both the Honeywell and the Department's micor to experiment with thinking skills applications.

Projected Uses: Three MSU specialists in CAI have been funded through the Faculty Vitality Committee for an interdisciplinary summer workshop in thinking and reasoning skills. The three investigators -- Joseph Bourque (English), Rita Flaningam (Speech Communications), Michael Lassner (Computer Science) -- will work in conjunction with a much larger project supported by the Fund for the Improvement of Post-Secondary Education (FIPSE). The combined effort is aimed at improving thinking skills.

A recent study at Montana State University, in conjunction with a faculty workshop in Piaget, revealed that 50% of MSU's students have not achieved Piaget's "formal operational reasoning" (the ability to think conceptually, especially by manipulating abstractions). Teachers in all disciplines are affected: from physics teachers baffled by students' difficulty in distinguishing between acceleration and velocity, to writing teachers who find that students have trouble building an organized essay around a central thesis statement.

The problem is widespread enough that the recent "Academic Competencies" statement prepared by the College Board lists five "reasoning competencies" that colleges should help students acquire: (1) the ability to identify and formulate problems; (2) the ability to use inductive and deductive reasoning and to recognize logical fallacies; (3) the ability to draw reasonable conclusions from information found in a variety of sources; (4) the ability to form generalizations and to comprehend abstract principles; and (5) the ability to distinguish between fact and opinion.

Most colleges and universities have no systematic plan for attacking these reasoning problems. Educators rely on osmosis, hoping that students will absorb reasoning skills as they study subject matter.

In the past few months, we have become increasingly aware that much of the recent research in CAI has been dedicated to the attempt to develop thinking skills. CAI is rapidly evolving beyond information-oriented exercises and has begun to focus on the potential of the computer to teach reasoning. Drawing on research in cognitive psychology, CAI specialists are beginning to devise a new breed of instructional programs with open-ended exercises engaging students in advanced thinking and directed problem solving. But no one has yet indicated successful curricular integration of CAI thinking skills programs designed to develop simultaneously both thinking skills and mastery of course content.

Fortuitously, MSU in now involved, through a substantial grant from FIPSE supplemented by matching funds from the university, in an experimental project involving the use of writing to teach thinking skills. The investigators for that grant hope to demonstrate that a well-designed sequence of writing assignments required by teachers in many courses throughout a four-year curriculum will enhance both writing and reasoning skills. One phase of that project is a summer workshop involving 30 MSU faculty from every college in working toward that goal. This was an ideal time for a computer adjunct project that could take advantage of the enormous resources of that workshop and contribute to it a new dimension. Further, since the FIPSE grant includes a cooperative effort with three other campuses (Georgia State, Beaver College, and SUNY Binghamton) there will be a further opportunity to combine computer efforts.

Our long range goal is to incorporate CAI thinking-skills modules into many courses in several disciplines. Our short range goal is to develop an original design for at least one CAI thinking skills program that could be easily adapted to the needs of various disciplines.

Computer-Assisted Design (CAD) Systems
and
Computer-Managed Instruction (CMI)

by Dr. Douglas DeLong, Northern Montana College

CAD/CAM Systems:

Computer-Assisted Design (CAD) deals with automated drawing as well as x-y coordinate data management. Computer-Assisted Management (CAM) involves the use of the computer as an information management device for design specifications, accounting data and materials data. My interests lie more in the area of CAD.

I am the Director of a Faculty Vitality Grant project (1981-82) with the purpose of developing software for a CAD system being used at NMC this quarter. The software developed will be used in conjunction with a commercial graphics package purchased from Tektronix Corporation (Plot-10 IGL package). Mr. James T. Smith and I developed the graphics routines during the summer of 81. At this point, the system consists of the following modules:

1. Draw routines for point-to-point draws (vector and absolute).
2. Size and scaling routines.
3. Special draw routines - circles and dotted lines
4. Automated dimensioning routines
5. x-y coordinate data management
6. Draw file building and access, and draw file editing.

A CAD system at its ultimate would include things as:

1. Draw routines for many special draws such as: elliptical, parabolic, logarithmic, and exponential curve arcs.
2. A variety of fonts and special symbol draws.
3. Three dimensional coordinate data handling (requires a large amount of RAM.)
4. Device drivers for all types of hard-copy graphics plotters such as large x-y flatbed plotters and drum plotters.
5. Ability to handle coordinate and specification data for automated draws of standardized detail drawings.
6. Transformation draws from previously constructed draw files. (This would involve the transformations of reflection, rotation, and dilatation.)

Equipment (in addition to the PDP 11/70 computer system at NMC) to be used with this project will be a Tektronixs 4006 computer display graphics terminal and DEC-writer computer terminals. The Tek-scope will be used for all graphics. Data file listings will be made using the DEC-writer terminals.

CAM Systems:

Patrick Suppes (Stanford) classed his original CAI routines into the following categories:

1. Drill and Practice Programs
2. Tutorial Programs.

The Drill and Practice Routine consists simply of a stream of drill exercises randomly generated by the computer program. Student response analysis for the generated exercises consists only of detection of erroneous responses. Reinforcement of correct responses is sometimes given. Tutorial programs offer the student step through solutions to an exercise based on some particular solution technique.

In addition to the Drill and Tutorial Program segments, a "good" CAI system should have the following:

1. Thorough response analysis including a search of incomplete, misspelled, or partially correct responses.
2. Tutorial program segments which may be activated by the user.
3. Pupil information management including storing and retrieving of evaluative data.
4. Prolific use of graphics. Graphics may be computer-generated and displayed via a CRT terminal or displayed using an automated visual display mechanism (like a computer-controlled slide projector or a video disk system).

Mr. James T. Smith and I are presently involved in developing some CAI software for instruction in the basic skills of arithmetic. Subject areas include whole numbers, integers, fractions, decimals, and percent. This overall software package includes drill and practice routines, tutorials (help routines), and information management for Pupil evaluation data.

A student user of the system is presented with a menu of subject matter areas. Upon choosing one of these areas, the student is presented with a collection of drill programs. Each drill routine produces randomly generated exercises for the student to attempt. The student may opt, at any time, to receive a step through computer-generated solution to a problem. Scores on each drill are stored on a disk file. Information management is an integral part of this system.

Computers in Physics

by Dr. Larry Kirkpatrick, Montana State University

During the past five years, computers have found an increasing variety of instructional uses within the Physics Department at Montana State University. The myriad of uses range from word processing to computer graphics to data acquisition in research and laboratory experiments.

Our earliest instructional use of computers was the introduction of two CAI programs on astronomy. These programs used graphics terminals connected to the main campus computer. The programs were rather sophisticated dialog programs that led students to an understanding of various motions that take place in the heavens. They incorporated illustrations and interactions with these drawings. They also utilized extensive branching to lead students to correct answers rather than simply telling them the answers. Unfortunately, we have not had the resources to adapt these programs to the new campus computer.

We are now in the planning stages of using the graphics capabilities of microcomputers in our large lecture classes. The use of computers has many advantages over the use of film. The parameters used in the problem can be adjusted to match those in the text. The instructor can control the pace of the presentation and respond to requests to see variations. For instance, we can use this system to demonstrate the addition of two waves. We begin with waves of the same frequency and amplitude and show the basic physics. Then in response to questions and/or suggestions from students, the instructor can show what changes occur when the frequency or amplitude of one of the waves is changed.

We have recently obtained five single-board computers for use in the senior labs. These will be used to teach our majors how computers are interfaced with experimental equipment to increase the ease, flexibility, accuracy and speed of data acquisition. This area has become very important in the education of our majors as almost all of our research equipment within the department (and across the country) has been computerized.

About 15 months ago the department bought its first microcomputer for use as a word processor. Since it became saturated with a few months, we began looking for a system with increased capability. We finally settled on two four-user systems; one primarily for the secretaries and the other for student and faculty use. These are constantly in use. Word processing has many instructional uses besides the obvious secretarial uses. It is very useful to faculty in preparing handouts, laboratory manuals, quizzes, and exams. We intend to maintain a bank of multiple choice questions for use in our lower division courses. The instructor will then be able to select and/or modify questions and assemble them for direct typing onto a ditto master. This saves secretarial time, reduces errors, and reduces the reluctance on the professor's part to make last minute improvements.

Word processing is now available to our graduate students for preparing research papers, conference reports, papers for classes and other written documents. This reduces the reluctance to revise the papre until it is well-written and eliminates many of the problems of typing up reports. I feel strongly that this facility should be made available to the undergraduates. This should result in a significant improvement in the quality of the written works that are produced.

One of our professors has begun assigning problems in his physics course that require the use of computers to solve. These are usually problems that have important physical consequences but that cannot be solved in closed form or, at least, are too difficult for the students. These problems can be rather easily solved using numerical approximation techniques on the computer. In addition, once a solution has been obtained, the relative importance of the various parameters can be investigated by simply varying their values and rerunning the program. In this way the students develop a better physical feeling for the problem. We hope to expand this use of computers to more of our classes.

Since the role of computers in instruction will continue to increase, we must plan for the future. We have been designing lecture facilities that will take full advantage of the micro-electronics revolution. In addition to the use of computer-generated graphics, we are exploring the use of a feed-back system to improve the participation of students in the lecture process. One could, for instance, wire each seat with a telephone keyboard that is multiplexed to an on-line computer. This could be used to solicit responses of the students during the lecture. Class opinions could be solicited and graphed on the monitors. A daily quiz question or two could be given rather than having a quiz once a week or rely on exams given every three or four weeks. The instructor would be able to find out whether the students have understood a topic or whether it should be covered in more detail. The system could also save a tremendous amount of record keeping, freeing more of the professor's time for personal interaction with students.

The possible improvements in instruction provided by the microcomputer technology are large and varied. This potential will only be realized through the efforts of a large number of dedicated people. This will require appropriate resources, rewards and cooperation within the Montana University System.

Experiences with a Computer Science Lecture Series

by Dr. John C. Marsaglia
Montana College of Mineral Science and Technology

During the 81-82 academic year, Montana Tech hosted a computer science lecture series. Funding for the series was provided by the Northwest Area Foundation and Montana Tech. The lecture series was used as a device to increase the faculty's exposure to relevant computer applications.

In the past few years, the computer has become a major tool in practically all professional disciplines. Likewise, software and hardware advances have made the computer into an attractive teaching tool. In almost every discipline offered here at Tech, the computer has become an important part. Thus to effectively train students for jobs, which actively use the computer, the faculty themselves need to be made aware of computer applications in their field.

The lecture series was seen as a cost-effective approach providing the opportunity for a large number of faculty to be exposed to computer applications within their field. The intention was to select lecture topics which would be directly related to the needs here at Tech. In the event that those type of speakers were not available, then it was hoped that a demonstration of a computer product from an unrelated area would be seen as a possible approach to a computer suited application at Tech.

Industry representatives were invited to the series, as guest lecturers and as members of the audience. The intent being to seek out information about the environments Tech graduates will enter and what industry representatives feel their preparation should be.

Finally, the series was seen as an approach to establishing communications within the university system and with industry professionals. It was hoped that output from this pool of expertise would help avoid unnecessary and costly redundancy in computer applications.

The goal of establishing communication within the university system units and with industry was met successfully. As a result, cooperative projects have developed and industry has become more involved with degree programs offered here at Tech. The contributions from industry have included equipment, staffing, and funding for specific degrees and the hiring of faculty members as consultants.

The primary goal of faculty vitality did not fare quite as well. At all presentations, faculty members were in the minority of the audience. Various reasons have been given, including conflicts in time schedules and lack of free time. Nonetheless, faculty vitality was the main reason for the series. With some modifications, the gues lecture mechanism could be a valid technique for distributing information to faculty. My topic is, therefore, to describe some features which may do just that.

Incentive would be increased if rewards were granted to those who kept abreast of current and developing applications within their field. A method would be to encourage individual faculty to go to workshops and then return and share their information. Currently, this type of activity is classified as professional development and there is a degree of reward. Additionally, research often requires that faculty members stay on top of computer usage developments. Research is also rewarded on the faculty members evaluation. However, because of the reduction in available research funds and decrease in travel money, these alternatives have become limited. These factors lead back to the method of inviting lecturers to share information. There have been several suggestions which may be sufficient to make the lecture series productive; they will be discussed during my talk. Some sample suggestions are:

- -- workshop environment, promoting individual interaction with the computer application.
- -- better techniques in displaying the product (i.e. video-tapes or video output).

MY INVOLVEMENT IN EDUCATIONAL MICROCOMPUTING AT E.M.C.

by Dr. W.A. Stannard, Eastern Montana College

Since 1977 I've been involved in educational microcomputing at E.M.C. Most of my involvement has been in connection with in-service education of teachers off campus. The only pre-service microcomputer teacher training we have at E.M.C. is by independent study -- which three or four students have requested I provide. Frankly, it is a lot of work to teach the course on an independent study basis.

There is talk of a computer awareness course for preservice teachers at E.M.C. The talk has delayed any serious action and although there are those of us who see microcomputing as an essential dimension of teacher training, I have no hope that the needed course will be implemented next year -- or as long as procrastinators can delay it.

Off campus microcomputing for teachers exceeds all expectations. I am currently cooperating with M.S.U. in offering an inservice course at Lewistown for 110 teachers. I've also been asked to teach a "telephone conference call" course from E.M.C. for outlying teachers who can't participate in existing inservice programs. Sometimes the pressure to offer such training comes by contracted service -- such as:

1. all day workshop for teachers and students at Terry, Montana,
2. consultant and trainer fo teachers of More Academically Able Program in Billings,
3. orientation of elementary principals of Billings Public Schools, and
4. consultant and trainer of teachers of academically able teachers of Corpus Christi Texas.

An important dimension of my involvement in educational microcomputing comes thru funded N.S.F. projects. I've been named project director for four N.S.F. projects, each aimed at bringing microcomputing to Montana schools. One such project is currently under way in Montana.

Also, adding to my involvement in educational microcomputing are the continuing requests for me to do talks before teacher groups. This year I've given three such talks and turned down as many other requests.

Finally, I believe the Montana University System should carefully consider microcomputing as one dimension of instruction which needs experimentation and development. Specifically I believe the exhorbitant expenditure of dollars and time spent in teaching/learning remedial mathematics at the post high school level in Montana could be significantly reduced by a suitable program of instuction featuring a harmonious mix of:

- CAI
- Conventional Lecture
- Video tape
- Programmed instruction
- Help sessions

I would like to develop such a course and carry out a carefully supervised instructional experiment to measure its worth.

Instructional Computing by Members of the Philosophy Department at UM

by Dr. Richard Walton, University of Montana

I believe that some work being done in the Philosophy Department at UM provides good examples of instructional computing, examples which illustrate three major forms of this important application of campus computer facilities. Members of the Department make use of the computer for instructional support; they prepare examinations, produce graphs of test scores, maintain gradebooks, etc. Computer Aided Instruction of the familiar sort has been used in our introductory logic course. Finally, the Department is now participating in a curricular experiment testing a new approach to teaching English composition, one based on the hypothesis that computer programming is a form of writing, in important respects simpler and more manageable than writing in a natural language, so that training in structured programming is valuable preparation for training in writing. This project, the UM Cooperative Composition Experiment (UMCCE), is funded by the Alfred P. Sloan Foundation, Inc. I am the project director.

As part of the faculty training for the UM Cooperative Composition Experiment, I taught several of my colleagues to use the computer for text processing. Three of us now use it regularly to prepare class materials, syllabuses, examinations, etc. For example, Ray Lanfear provides his humanities classes with digests of his lectures on the Old Testament, Augustine's _Confessions_, and Dante's _Inferno_. These are written and edited on the computer, and printed on the line printer. Students have found these digests invaluable. Without the computer, it would have been very difficult to have provided them. We use a record-keeping program called "FILES" to maintain gradebooks in elementary logic. This program creates marvelous graphs which are immensely helpful in evaluating student performance.

I have taught elementary logic at least once each year since 1970. Except for about three classes in the years 1977-1980, the performance of students has always exhibited a certain pattern; no later than mid-quarter, the class divides into two well-defined groups, those who are assimilating the material quite well -- about two-thirds of the class -- and those who never seem to get past some barriers to understanding -- the remaining one-third of the students. Average scores on 100 point examinations usually fell in the 60's, the highest average ever was 72. Curves, however, were neatly bi-modal, a mountain, its peak at about 80, and a foothill, topping out near 45. To attack this problem of "stragglers", I introduced computer aided instruction, using two quite simple programs, one of which offered drill on concepts, the other checked proofs. (See attached descriptions.) My foothill disappeared. For thee years, overall class performance was greatly improved; there were relatively few "stragglers", and test averages jumped into the low 80's. These simple, effective CAI programs are not now being used because students no longer have adequate access to the computer.

Like most U.S. college faculties in the mid-'70, we at UM became very concerned about an obvious decline in our students' ability to write. The English Department formed a committee to study the problem in 1977. I served on that committee. I was then in the midst of two apparently quite unrelated projects; I was writing a paper on Socrates, and I was writing some computer programs to analyze department enrollment patterns. I was using the computer as a text processor to write my Socrates paper. Hence, for about two months, I spent a good deal of time at a computer terminal either working on a piece of scholarship in philosophy or on a BASIC program. I soon noticed that there were some interesting similarities in what I was doing. I made the same kind of notes for both writing jobs; they were outlines, of sorts. I thought in the same way about organization and revision. And I notice that the programming was much easier. It occurred to me that training in programming might be good training for writing. I researched that idea, discovering in the process the "structured programming" movement in computer science. Ultimately, I prepared a paper on the topic, which, together with a budget, became a grant proposal to the Sloan Foundation. We are now in the late stages of testing this hypothesis. We have already shwon that a powerful design tool used in programming, the Warnier-Orr diagram, is equally valuable to writers of prose. The UM Cooperative Composition Experiment will complete its work next year.

To most peoples' minds, "instructional computing" means computer aided instruction of the familiar form, viz., that in which the student, seated at a terminal, responds to queries displayed on a video screen. In short, the student interacts with a program prepared by someone else. This is a valuable variety of instructional computing, and it will perhaps become more valuable as it becomes more available and colleges and universities are faced with more "non-traditional" students. It is not the only variety of instructional computing. We must count instructional support as instructional computing, as well, and make possible its use on a widespread basis. It, too, can greatly improve the quality of our work. Perhaps most importantly, however, we must recognize programming as a general discipline, a form of problem-solving and a form of writing. Hence, proper training in programming must be accorded a place in the core curriculum.

COMPUTER CONFERENCE PARTICIPANT LIST

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